

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
16 August 2001 (16.08.2001)

PCT

(10) International Publication Number
WO 01/59938 A2

(51) International Patent Classification⁷: **H04B 1/00**

(21) International Application Number: PCT/US01/03983

(22) International Filing Date: 7 February 2001 (07.02.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/503,076 12 February 2000 (12.02.2000) US

(71) Applicant: QUALCOMM INCORPORATED [US/US];
5775 Morehouse Drive, San Diego, CA 92121-1714 (US).

(72) Inventors: STANDKE, Randolph, E.; 13283 Boomer
Court, San Diego, CA 92129 (US). BURKE, Joseph, P.;
3478 Corte Clarita, Carlsbad, CA 92009 (US). HEID-
MANN, Peter; 3354 Avenida Nieve, Carlsbad, CA 92009
(US).

(74) Agents: WADSWORTH, Philip, R. et al.; Qualcomm In-
corporated, 5775 Morehouse Drive, San Diego, CA 92121-
1714 (US).

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW.

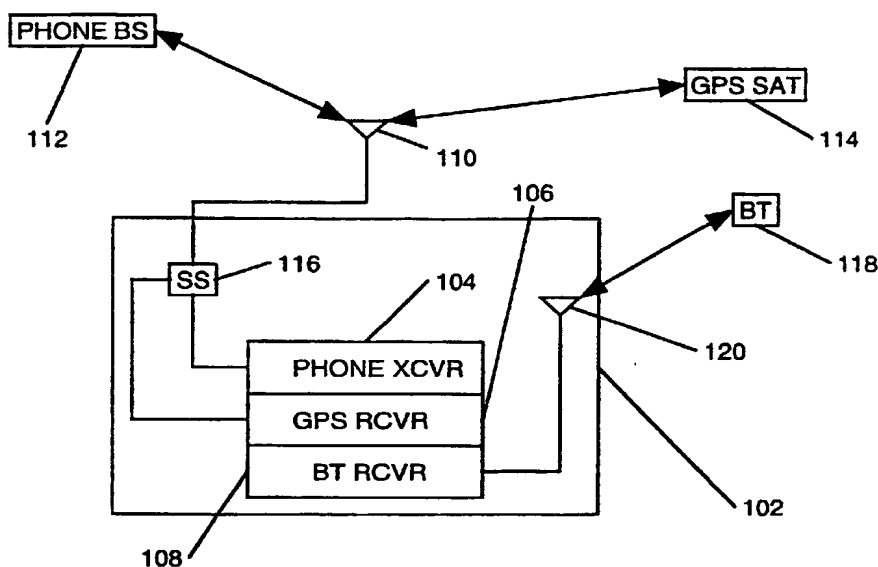
(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:

— without international search report and to be republished upon receipt of that report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: MULTIPLE BAND WIRELESS TELEPHONE WITH MULTIPLE ANTENNAS



(57) Abstract: A wireless telephone (102) includes a telephone transceiver (104), GPS receiver (106), and Bluetooth transceiver (108). The telephone antenna (110) is external, and the Bluetooth antenna (120) is internal. The GPS receiver (106) may be driven by its own internal antenna (326), or via a signal separator (116), (216), by either of the other antennas (110), (120).

WO 01/59938 A2

MULTIPLE BAND WIRELESS TELEPHONE WITH MULTIPLE ANTENNAS

5 BACKGROUND OF THE INVENTION

Technical Field

[1001] This invention relates to wireless telephones, and has particular
10 relation to antenna architecture for multiple band wireless telephones.

Background Art

[1002] Wireless telephones have long had to operate in multiple frequency
15 bands. The older cellular telephones operate at 800 MHz, while the more
modern PCS (Personal Communication System) telephones operate at 1900
MHz. This could be done with a single antenna, operating as a quarter-
wavelength antenna in the first band and as a half-wavelength band in the
second. As additional features become available, however, additional antennas
20 must be used. This is undesirable, since it adds to the weight and bulk of what
is intended to be a lightweight, compact, and (most importantly) portable
product – a wireless telephone.

BRIEF DISCLOSURE OF THE INVENTION

25 [1003] Applicants have overcome the limitations of the prior art, at least
where the additional features are GPS and Bluetooth.

[1004] GPS is the Global Positioning System. A ground-based receiver
receives precisely timed signals from several satellites. Each satellite has a
30 precisely known position, a code for which is also included in the signal. By
noting the time (and the differences in time) at which each signal is received,
the receiver can calculate its own position. GPS operates at 1575 MHz.

[1005] Bluetooth is a project of the Bluetooth Special Interest Group. Its
website as of the filing date of the application, at <http://www.bluetooth.com>, is

without cables. It does so by using a low-power, short-range (10-100 meter) radio link, operating at 2400-2483 MHz.

[1006] The present invention provides wireless telephone, GPS, and Bluetooth capabilities in a single device with a single external antenna. Three
5 embodiments are shown.

[1007] In the first embodiment, the telephone is designed to operate in only one telephone band. The external antenna is tuned for a multi-band response to access both telephone and GPS. A diplexer or electronic switch separates the telephone and GPS signals. An internal antenna is used for Bluetooth.

10 [1008] In the second embodiment, the telephone is designed to work in two telephone bands. The external antenna is used for both telephone bands. A single internal antenna is used for GPS and Bluetooth, with a similar diplexer or electronic switch.

[1009] The third embodiment is similar to the second, but uses two internal
15 antennas, one for GPS and the other for Bluetooth. The diplexer or electronic switch is omitted.

BRIEF DESCRIPTION OF THE DRAWINGS

20 [1010] FIG. 1 is a block diagram of the first embodiment of the present invention.

[1011] FIG. 2 is a block diagram of the second embodiment of the present invention.

[1012] FIG. 3 is a block diagram of the third embodiment of the present
25 invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

30 [1013] FIG. 1 is a block diagram of the first embodiment of the present invention. A wireless telephone (102) has a telephone transceiver (104), GPS receiver (106), and Bluetooth receiver (108). An external antenna (110) receives telephone signals from a remote telephone base station (112), and also receives GPS signals from a constellation of remote GPS satellites (114). These signals

The signal separator separates the telephone signals and the GPS signals, and applies the telephone signals to the telephone transceiver (104) and the GPS signals to the GPS receiver (106). A remote Bluetooth device (118) sends signals to an internal Bluetooth antenna (120), which applies the Bluetooth signals to the Bluetooth receiver (108).

[1014] FIG. 2 is a block diagram of the second embodiment of the present invention. FIG. 2 is generally the same as FIG. 1, with two exceptions.

[1015] First, the external antenna (110) of FIG. 1 has become external antenna (210), since it has been optimized to receive telephone signals on two bands rather than on one band. Signals on a first band are received from a first remote base station (222), and signals on a second band are received from a second remote base station (224). The two base stations may be co-located, and may even share an antenna, but are considered to be separate since they operate on different frequency bands. The single-band telephone transceiver (104) of FIG. 1 is changed to become dual-band telephone transceiver (204) of FIG. 2. Dual-band telephone transceivers sharing a common antenna are known in the art.

[1016] Second, the signal separator (116) of FIG. 1 has become signal separator (216) of FIG. 2, since it separates GPS and Bluetooth signals rather than GPS and telephone signals. Internal antenna (120) of FIG. 1 has become internal antenna (220) of FIG. 2, since it has been optimized to receive both GPS and Bluetooth signals, rather than just Bluetooth signals. The signal separator (216) receives Bluetooth signals and GPS signals from the internal GPS antenna (220) and separates the two signals. It then applies the Bluetooth signals to the Bluetooth transceiver (108) and the GPS signals to the GPS receiver (106).

[1017] FIG. 3 is a block diagram of the third embodiment of the present invention. FIG. 3 is generally the same as FIG. 2, with one exception. The signal separator (216) has been removed, and a separate, internal, GPS antenna (326) has been added, which directly applies GPS signals to the GPS receiver. The Bluetooth antenna (120) applies Bluetooth signals to the Bluetooth transceiver (108), as in FIG. 1.

Industrial Application

[1018] This invention is capable of exploitation in industry, and can be made and used, whenever it is desired to provide a wireless telephone with GPS and

4

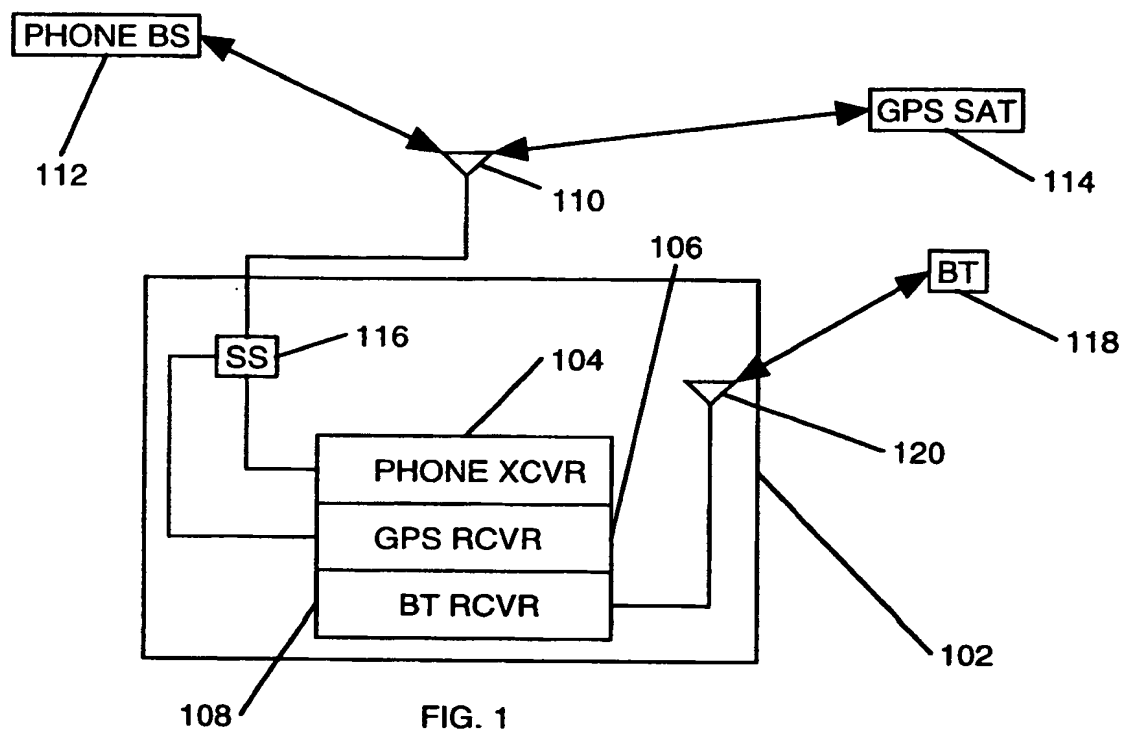
method shown herein, taken separate and apart from one another, may be entirely conventional, it being their combination that is claimed as the invention.

5 [1019] While various modes of apparatus and method have been described, the true spirit and scope of the invention are not limited thereto, but are limited only by the following claims and their equivalents, and such are claimed as the invention.

5
CLAIMS

- 1) A wireless telephone, wherein:
- 2 a) the telephone includes:
- 4 i) a telephone transceiver;
- 6 ii) an external antenna connected to the telephone transceiver;
and
- 8 iii) a Global Positioning System (GPS) receiver and antenna;
and
- 8 b) the telephone is *characterized in that* the telephone also includes
a Bluetooth transceiver and internal antenna.
- 2) The wireless telephone of claim 1, *further characterized in that* the
2 telephone further includes a signal separator connected to:
- 4 a) receive telephone signals and GPS signals from the external
antenna;
- 6 b) separate the telephone signals and the GPS signals;
- 8 c) apply the telephone signals to the telephone transceiver; and
- d) apply the GPS signals to the GPS receiver.
- 3) The wireless telephone of claim 1, *further characterized in that* the
2 telephone further includes a signal separator connected to:
- 4 a) receive Bluetooth signals and GPS signals from the internal GPS
antenna;
- 6 b) separate the Bluetooth signals and the GPS signals;
- 8 c) apply the Bluetooth signals to the Bluetooth transceiver; and
- d) apply the GPS signals to the GPS receiver.
- 4) The wireless telephone of claim 1, *further characterized in that* the GPS
2 antenna telephone is internal and separate from the Bluetooth antenna.

1/3



2/3

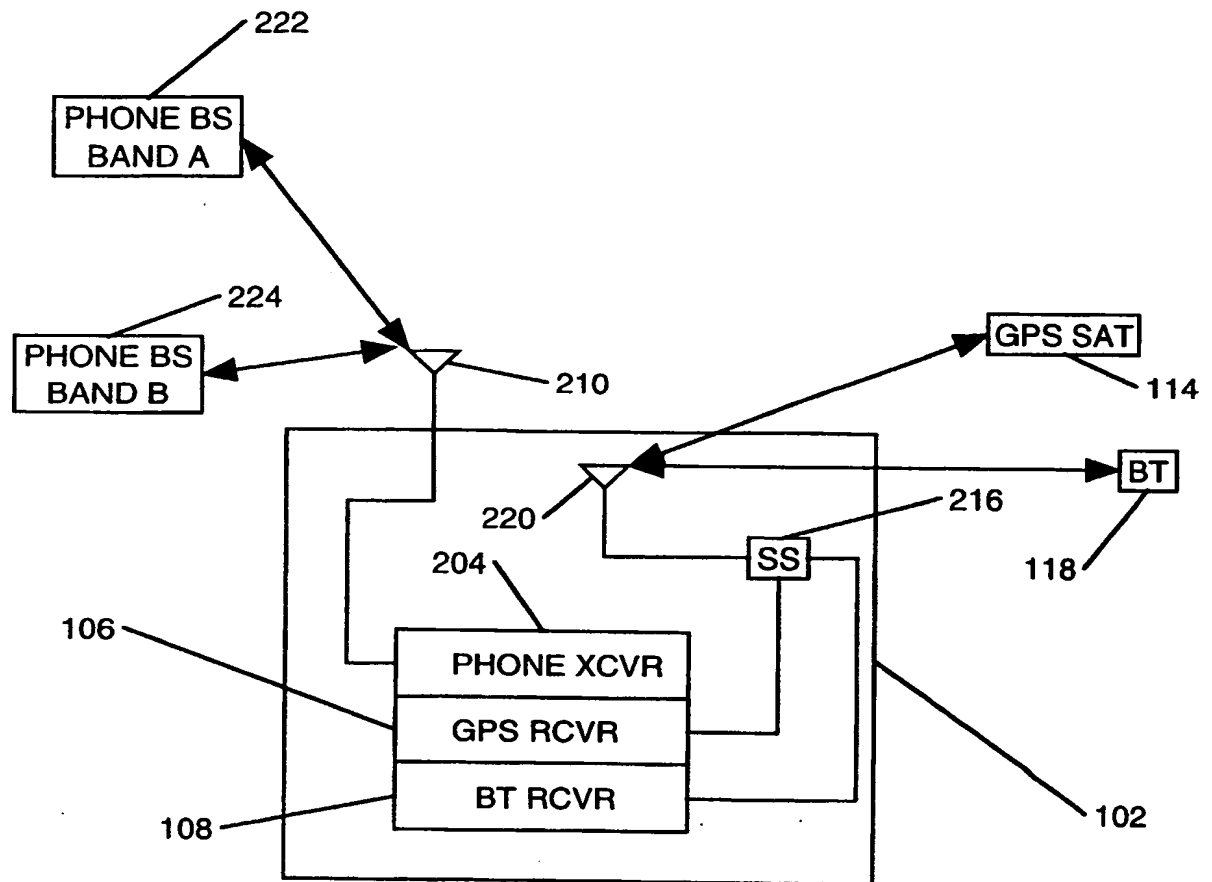


FIG. 2

3/3

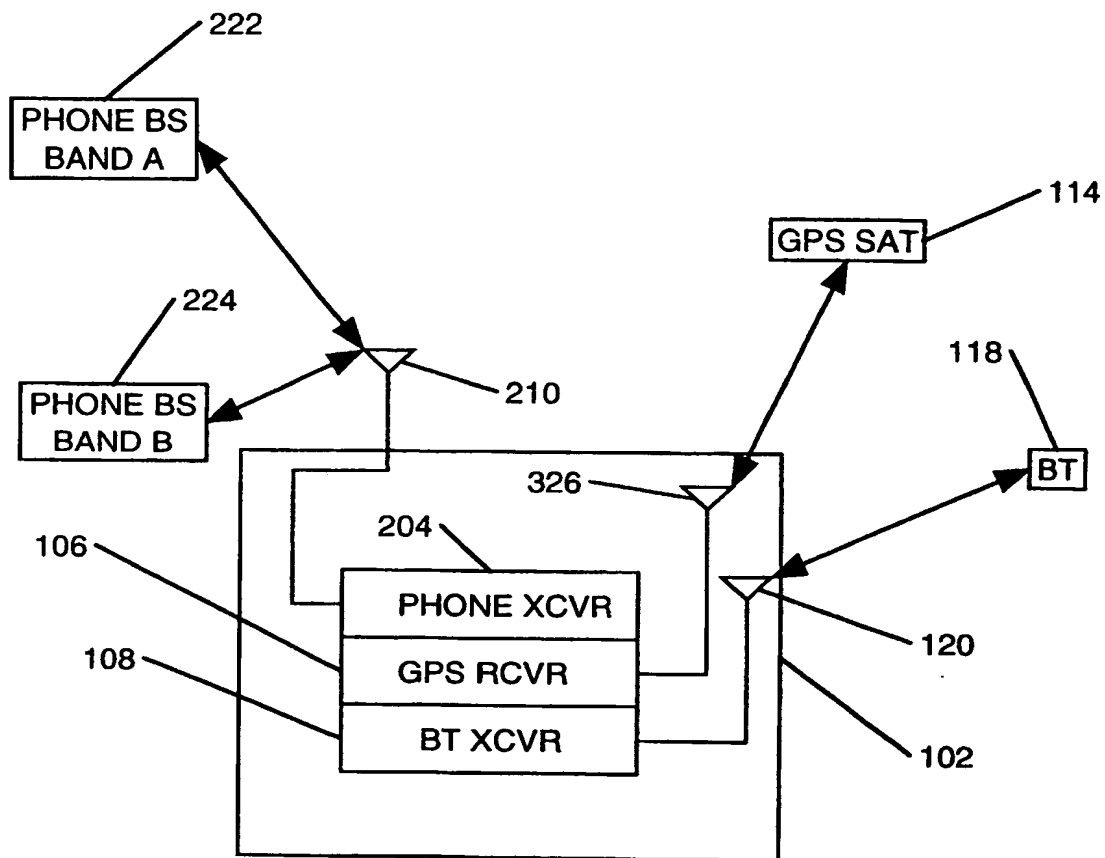


FIG. 3